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Designing schools for quality

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A useful addition to the discussion would have been the roles which communities do play (or can play) in sustaining school infrastructures. This was alluded to in Lines 24-28, Page 6 of the reviewed document; however, there were no references cited to buttress the "involvement and commitments of the local communities as stakeholders..." (Lines 25-28; Page 6) or to whole school development in general .

This section has been expanded and the suggestions incorporated.

Some discussion on communities' contributions to school infrastructural enhancement is presented in
http://www.communityschools.org/assets/1/AssetManager/WkshpI_GregHall_GuideCS_Transformation.pdf.

This and other references have now been included.

Line 15, Page 3 ["Firstly, classrooms tend to be part of a block of three or four classrooms...]may need to be modified to ensure clarity..

Paragraph rewritten and expanded.

In general, there is the need for consistence in incorporating references in the text. For instance, should the references be part of the sentences as in Lines 9-10, Pages and Line 59, Page 10 or as stand alone as Line 42, & Line 44, Page 4; Line 31, Page 5 etc.

References have been restructured and made consistent.

In general, there is the need to re-structure the Bibliography Section... For instance, is the reference "South African Government (2008)" [Line 59, Page 14, the same as the reference "South African Govt (2008)" [Line 2, Page 15]?

Bibliography fully revised and restructured in keeping with journal requirements

Designing schools for quality: An International, Case Study-based Review

Abstract

Universal access to primary schools is a key millennium development goal, still proving difficult to deliver in low-income countries. Schools designed for the poorest remain inadequate for the numbers enrolled, and for the basic needs and functions of today's classrooms. The key issue is overcrowding; classrooms designed for forty regularly accommodate more than sixty due to the use of outdated international classroom design standards. These schools also have poor access to infrastructure; electricity, drinking water, sanitation, and ICT/library spaces. This paper highlights these issues and suggests strategies for improved school design through the evaluation the EdQual research project school case studies, the author was involved with, and also recent international examples. It is argued that schools designed considering these issues, can become 'hubs' for development; providing local assets that can be shared by their communities.

Introduction

Historically, the physical presence of the schoolhouse has been the symbol of the success of grassroots delivery of national education policy worldwide. In this chapter it is argued that historic international school design planning standards and guidelines have remained overly influential in shaping school design in low-income countries today. The ability of contemporary school design to respond to wider functions of schools within the context of expanding feeding programmes, increasing availability of ICTs and changing community development needs is examined.

Drawing from literature and research carried out as part of the EdQual-funded standalone research project, “Designing Learning Hubs for Education”, the potential for classroom design and school infrastructure to improve education quality and support community development is examined. International examples of good school design practice are considered, and a design infrastructure analysis of selected case study schools is undertaken. Future trends in classroom design in relation to student experience and community outreach are discussed. The chapter concludes with recommendations for school design guidelines to become more tailored to local pupil and community needs.

The Historical dominance of international classroom design

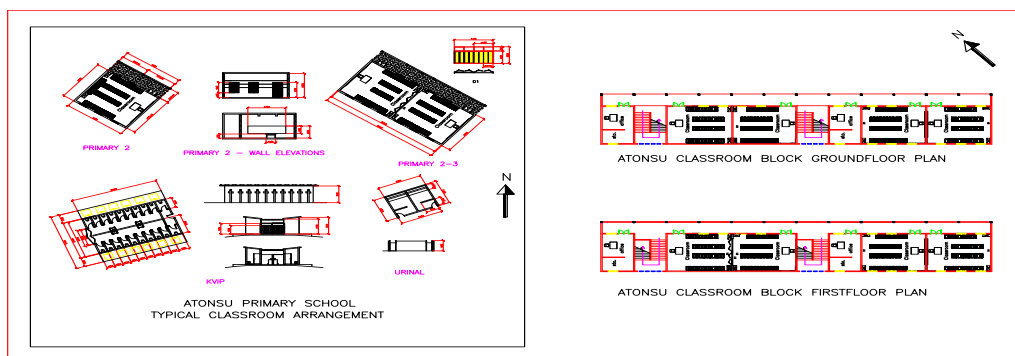
In pre-1994 South Africa, school buildings were often the sites of conflict as their existence was perceived as being a direct link to nationalist “Bantu” education policy in place in segregated schools for black South Africans, from the 1960s up until the 1980s, Kallaway, (2002). Internationally today schools, and particularly classroom buildings, retain their symbolic connection with top-level policy agendas as education ministries, international aid and finance organisations have supported the expansion of national school building programmes in order to meet the Millennium Development Goal of universal primary school access for all children, UN, (2000) UNDP, (2005).

For most low-income countries, school planning and design standards currently in use originate directly from the recommendations of planning reports from international bodies such as the United Nations education, science and culture organisation, UNESCO. Prior to 1996, UNESCO’s school planning division, produced a number of influential building notes and reports that have formed the basis for international school design standards across low and middle income countries, including the following: Vickery, (1966) Asian Regional Institute for School Building, (1973), and Almeida (1988).

The School Building Research Institutes, whose architects produced these reports, had divisional headquarters in Bangkok, and Dakar. The research institutes focused on producing a number of these school design guides, which were adopted by National Governments and building consultants involved in the construction and expansion of schools from the mid-1960s to the early 1980s; for example De Spiegeleer, (1988) in Bhutan, and UNESCO, (1976) for Somalia.

These universal standards continue to provide generic design advice for schools globally. In middle-income countries, there is also a level of involvement from the national level. For example, in South Africa, school planning and design is guided by National School Building 'Norms and Standards', SA Govt. (2008), that were historically developed by researchers and departments such as the Building Division of the Council for Scientific and Industrial Research (CSIR), Calderwood et al, (1966) These guidelines are devolved to Provincial level Planning Departments for use in school planning and construction projects. Such design guidelines however are unable to give location- or context-specific advice to educational planning officials, but instead offer standardised international space standards and generic planning layouts.

Effectively, the planning and design of most schools in low-income countries, involves limited design input or planning at local level. This situation is in direct contrast to other areas in which educational planning and delivery are being enhanced, such as the development of national school curricula, where local and national involvement in educational change and delivery are central to project success.



Insert figure one around here

Fig 1.0

A typical UNESCO-guidelines school classroom Atonsu Primary School, Ghana built. c 1955/60

Author's photograph 2007.

There are some distinctive features of the generic “UNESCO-standard” classroom. Classrooms sizes are generally between 35m² and 40m², the optimal space requirement for a maximum class of circa 35 students. Most are designed as individual rooms, with few having flexible back- or side- walls to allow for double-sized or semi-outdoor classroom areas respectively.

The classroom blocks tend to be low, single-storey structures, although there are variations to this in urban areas (Fig. 1). These classroom blocks are built as part of a series of three to four connected rooms, with an outdoor corridor to one side that runs the length of the classroom block. The corridor is where the doors are placed, for access to each classroom. Window openings are also placed on the classroom walls facing the corridor and on the long walls on the opposite side of the classroom.

In rural areas windows are left as bare openings in classrooms, whilst in most schools windows are made of wooden shutters. Only in urban areas and schools for the more affluent, are glazed windows incorporated. Windows are placed that they are able to ensure that daylighting comes in at the correct desk level for older, middle to upper school children. However this is not ideal for younger pre-school children and those in early years of primary school, particularly when child-sized classroom furniture has been introduced.

Most classroom walls are made from locally made cement blocks, and occasionally clay or mud brick. In rural and poorer neighbourhoods, school walls have no rendered or paint finish, whilst schools in higher income neighbourhoods have rendered and painted walls. Similarly basic flooring involving a finish of cement screed is typical in most rural schools, and in poor to middle income urban neighbourhoods. However in some medium-income countries, such as South Africa and Malaysia, schools might have PVC or linoleum floor finishes, and occasionally partial carpeting in pre- and early- primary classrooms.

Classroom roofing and ceilings also show little variation. Most school classroom blocks in rural and low income urban areas have corrugated iron roofing sheets, often with no ceiling materials, making classrooms hot, due to direct heat radiation, and noise due to the poor acoustic qualities of the roofing sheets. In emerging countries and upper to middle class neighbourhoods, other roofing materials such as longspan aluminium and sometimes clay tiling are more likely to be used. Also these classrooms roofs will have ceilings, usually made of fibreboard material. Occasionally acoustic ceiling tiles, are

used, which helps to improve classroom acoustics and deaden the sound effect of tropical rainfall.

In most schools sanitation facilities, for hygiene reasons, are usually built as a separate, standalone building, some distance from the classroom. In rural areas and poorer neighbourhood, WC's are dry pit latrine, usually of the ventilated improved pit (VIP) type. In more affluent neighbourhoods, and emerging countries flush WCs are the norm.

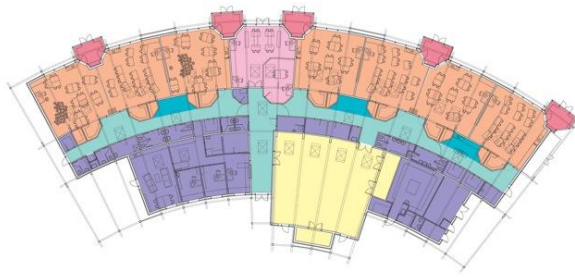
The administration block and other ancillary facilities such as the school library and in some cases science laboratory and ICT rooms, usually occupy the same area of the standard classroom. In smaller rural schools a classroom or classrooms at the end of a 3 - 4 classroom block will be converted to take on these functions. In richer schools such facilities will have purpose built buildings designed for these different purposes.

With the increased involvement of the World Bank, in school funding from the 1980s, came new published guidelines on school design and planning, World Bank, (1988), (1997), White, (2004), focused on improving efficiency and reducing building costs, through the use of local labour and materials for school building. More recently, NGOs and high profile architecture and building practices have become involved in school design projects across low-income countries. Some have worked with existing guidelines, whilst others have developed their own design expertise; Brislin, (2008), Foster, (2009). However, for most pupils in rural or poorer urban areas, schools are still planned and designed to these historic international standards.

New Schools and Concepts in School Design

There are now a number of contemporary international examples of the re-interpretation of educational space that diverge from the conventional UNESCO-inspired design standards. Since end of World War Two, particularly from the late 1950s in Europe and the West, educationalists have supported the development of child-friendly learning spaces where primary school classrooms have evolved to become more representative of the everyday home environment of the child with workspaces that have shed the Victorian-era formality of the pre-1950s classroom design layout. The promotion of the child-centred learning model in primary education pedagogy, has been one of the international drivers behind transformation of school design (Dudek, 2006, Woolner, 2010, Hille, (2011). This has resulted in the child-scaled design of classroom elements such as windows and learning spaces, which are designed at a more intimate scale. Furthermore the placement of child-sized furniture in groups for collaborative learning,

The most recent driver of school design innovation has been the need to respond to new sustainability in building design and energy consumption criteria. Since the mid-1990s in some high-income countries, such as the United Kingdom, and the USA, all public structures including schools now have to have a sustainability building design audit, to ensure that schools do not contribute to the depletion of local resources in their design and methods of using renewable energy and natural thermal control, reduce dependence on non renewable energy sources.



INSERT Fig 2, Kingsmead Primary School interior of classroom. AROUND HERE
Photo Credit: White Architects, 2006

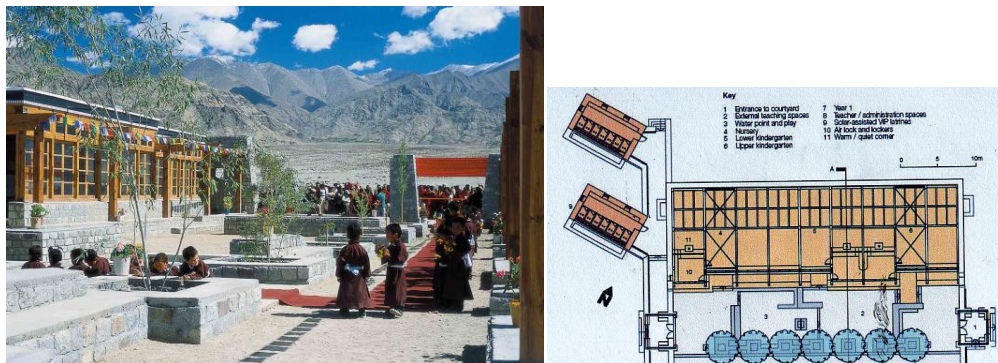
Kingsmead Primary School was designed as an exemplar school to meet with sustainable design requirements that had been introduced in Britain since its ratification of the Kyoto climate change protocol, UNFCC, (2005). It is located in Cheshire, England and was built in 2004, as part of the British Labour government's New School Buildings Programme. (CABE, 2006, BSF, 2008) The primary school caters for 150 pupils within a recently built housing estate. Its fan-shaped plan design allows for future extension. Classrooms are flexible spaces with folding door panels, which can be used to sub-divide the classroom, depending on flexible group teaching needs. The hall and ancillary areas near the hall are designed to be available for use out-of-school hours by the local community. The learning spaces are designed to maximise use of natural lighting and views to the external environment. They are well-ventilated, with operable windows, which provide naturally cooled rooms in summer. An energy-efficient heating system has been installed for use in cooler winter months. The school building has been designed using a wooden frame and panelling from local sustainable sources. Also there is a 'grey' water recycling system that enables rainwater to be used for toilet flushing.



INSERT Figure 3 Escuela Nueva Esperanza Ecuador Community learning space, used by children, built of entirely local materials AROUND HERE.
al borde architects (David Barragán & Pascual Gangotena)
Photo Credits : Esteban Cardena, Francisco Suarez y Pascual Gangotena (2009)

A more radical interpretation of learning has taken place with the emergence of the *nueva escuelas* movement in Latin America. Inheritors of the earlier 'conscientization'

movement schools underpinning mass education programmes in Latin America and elsewhere in the 1960s and 70s, Versions of *Nueva escuelas* exist in India and other low-income countries. *Nueva escuelas* schools make use of existing infrastructure in communities such as houses or church halls, Pineda et al, (2006). The community becomes involved in both supporting and physically accommodating the school as part of its fabric. This adapt and ‘make-do’ approach to learning space remains central to enabling educational access for some of the poorest communities, for whom traditional schools are in short supply and school upkeep costs might be prohibitive.



INSERT Figure 4. White Lotus School and layout plan AROUND HERE
Photo Credit: Caroline Sohie Arups Architects 2008

The Druk White Lotus School in Ladakh (fig 4) also shows a different response to contemporary school design considerations (Brislin, 2008). Designed by Arups Architects in India as a multi-age educational facility serving the remote Himalayan mountainous region of Ladakh, for children ranging from Nursery to High School age. It also has residential accommodation for students, who travel from distant villages. Its classrooms are designed to be flexible and open out into a courtyard space that is also used for teaching and promoting experiential learning. The school campus already includes a library for student use, and will also have a community health care facility. (Arups, 2011) All classrooms are fully illuminated by natural daylight and can also be used in the evenings for community functions with the use of lighting powered by solar photovoltaic arrays. The photovoltaic cells also power all the school computers. The school is designed to use natural ventilation, and energy efficient heating when required. Two site boreholes provide drinking water for students, whilst there are ventilated improved pit latrines for sanitation. Furthermore classrooms were designed using locally available granite and mud bricks.

The holistic success of these international examples, which reinterpret the relationship of the learners and community to the school are ultimately dependent on the involvement and commitment of the local community as both stakeholders and participants in local school projects, be they educational, social, developmental or other. Whilst the concept of local involvement in schools is not new, as evidenced by the Village College movement, Gropius and Fry's Impington Village College (b.1939) being one of the best historical examples. (Jeffs, 1999) contemporary community schools has evolved from the American school experience from the 1980s, with states such as Illinois were at the forefront of the movement. (Federation for Community Schools, 2015)

Versions of the community school ideal have been incorporated into a number of schools across the world, including Ghana, Mali, and Australia. (Carneal, 2004, Trinnick et al 2013) Also the UK Labour government's pre 2007 'Surestart school partnership' Programmes set up in the UK based their family-school outreach programmes on similar ideals, which have been retained by educational units in some councils such as Surrey. (Hansey Green, 2012) The importance of promoting a virtuous educational access circle, encompassing improved school design, shared school facilities for local outreach and, through this, improvements to child and community development, has been commented on by authors including Smit and Hennessy (1995), CSIR (2005), Dudek (2000) (2006) and Uduku (2000), (2010).

Furthermore all three schools use natural means of ventilation, and cooling, sustainable local materials in their construction, and both Kingsmead and Druk White Lotus school use forms of renewable energy. (CABE, (2006) Arup (2008) Druk White Lotus using solar photovoltaics for power, whilst Kingsmead uses both photovoltaics, and solar water heating systems, it also has an energy efficient heating system for use in winter.

EdQual School buildings Research

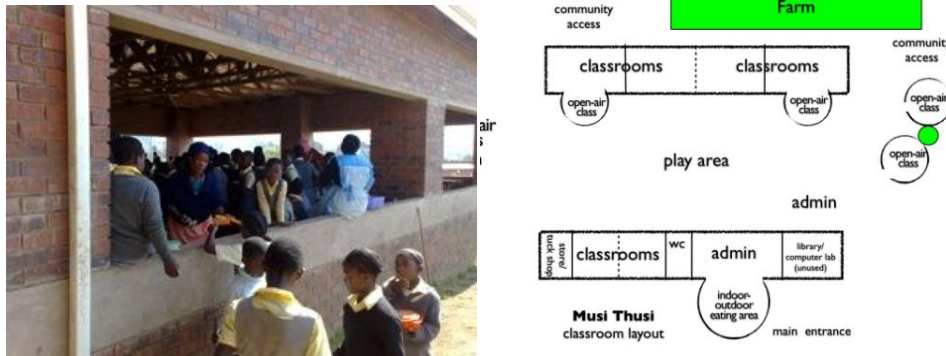
In the EdQual project, *Designing School Buildings as Development Hubs for Learning*, the researchers sought to understand what effect school design had on children's learning experiences and what additional development 'value' the school offered its surrounding community. Uduku, (2010) Field research conducted in 2007 consisted of two-day study visits to ten primary schools in South African and a further five primary schools in Ghana. During these visits, researchers conducted in-depth interviews with staff, students and community groups, photographed the compound, observed use of school buildings and drew up measured architectural surveys. The research team mainly consisted of architects, including co-researchers from CSIR, Pretoria and KNUST, Kumasi.

A number of criteria were used for school selection. All were state-run and located in non-affluent neighbourhoods, with both rural and urban locations included, covered both . Three of the case study schools are now described and discussed in detail. Between them, Atonsu Primary School in outer Kumasi, Ghana; Vukani Primary school, in Crossroads Township, Cape Town and Musi Thusi Primary School, in KwaZulu Natal provide a broad representation of the range of school types studied and illustrate some of the more innovative features observed.

Table 1: SELECTED EDQUAL CASE STUDY SCHOOLS DESIGN CHARACTERISTICS

SCHOOL	SCHOOL LOCATION - TYPE	DESIGN FLEXIBILITY FEATURES	DESIGN OUTREACH FEATURES	SANITATION
Musi Thusi Primary School <i>KwaZulu Natal South Africa</i>	Rural	Classrooms designed with moveable walls Outside teaching areas	Community involvement in school farm	Flush WC system in place, problems with maintenance
Atonsus Primary + Middle School <i>Kumasi Ghana</i>	Peri-urban (town outskirts)	1950s/60s classroom design with moveable walls	Community-built library for local & school use	Ventilated pit latrine system, poorly maintained
Vukani Primary School <i>Cape Town South Africa</i>	peri-urban (township)	School designed to enable admin/ICT classrooms use out of school hours by others.	Library/ICT classroom used for evening adult basic education classes	Flush WC system in place, problems with maintenance

Musi Thusi Primary School, was built c.1996 after South Africa's return to self-rule using local brick and building materials. The classrooms are built in sets of four to enable classroom floor area to be doubled by sliding back dividing partitions. Furthermore, there were carefully designed open-air areas where teaching and children's play took place. Atonsus Primary School, built by the British colonial government in the 1950s, initially as a middle school with a technical wing, is now a primary school. In 2007, when data was collected, it was one of the pilot schools 'trailing' the Ghanaian pre-primary school-feeding programme. Vukani Primary School was built in 1998, post South African self-rule. It was the second school to be built from the design plans of the architect W. Viljoen and not the Western Cape Province Education department. The classrooms are designed to the South African government's 'norms and standards' but the form and space use of the school responds to the architect's more playful interpretation of the first version of the primary school, and its rural location in the Paarl hills in the Western Cape.



INSERT Fig 5. *Musi Thusi semi outdoor refectory /community space AROUND HERE*
Credit: Author's own 2007

The key aspects of school design identified as having had the most effect on students' learning experience across the fifteen schools studied were classroom size, school adaptability to incorporate different school activities including; feeding programmes, library and ICT usage, and the provision of adequately designed sanitation facilities. Also the way in which the design of building facilities in each school encouraged local community outreach and use was considered crucial to the 'holistic' learning process at student and community level.

Classroom Size and overcrowding

Aside from the non-provision of primary schools in areas of most need, the overcrowded classroom was the most frequently identified problem affecting the learning experience of children. The two case study schools with the most pragmatic design response to this were Musi Thusi and Atonsu primary schools in South Africa and Ghana respectively. The former a 'new' post-1994 school built in a rural area and the latter a 1950s school block built in an urban area in response to an earlier education programme. In both schools a moveable internal partition between two equally sized classroom spaces gave access to a larger teaching space. It also allowed for the after-school hire of these larger classrooms by community groups for different purposes. The quality of the classroom partitions does vary. This affects the acoustic properties of the partitioned rooms. Well-designed partitions are expensive to acquire and install, however for the case study schools, their installation would be critical to resolving the limited space available for the large class sizes in normal classrooms.

Designed Facilities for School-feeding programmes

All three case-study primary schools had functioning pre-school feeding programmes, and school buildings, which had some design interventions responding to the requirements of children's meal consumption during the school day. Design provision was most integrated at Vukani Primary School, where a school kitchen was part of the original design, providing an area for the cooking and distribution of the school meals. Musi Thusi Primary School had a communal space, which acted as an semi outdoor cafeteria, where children had food served and could sit in to eat their meals. Both schools had school farms, at Musi Thusi school farmland was given to the local community who

were able to benefit from any surplus produce not used for the school feeding programme. Atonsu Primary school had no school farm but had a new purpose-built pre-primary classroom block and an adjoining kitchen store, providing food storage needed by the pilot school feeding scheme.

Without a dedicated school 'cafeteria' are like that of Musi Thusi, children at both Vukani and Atonsu Primary schools ate their meals in classroom teaching spaces which doubled as 'cafeteria' spaces at break times. Coupled with the overcrowding situation, particularly problematic at Vukani Primary school, the dual-use classroom situation was problematic for teachers to supervise. It also raised hygiene issues as food was served from a separate kitchen block, more than 50 metres from the pre-primary classrooms.

The ideal school feeding solution would be to have dedicated cafeteria areas within each school, connected to a food preparation and distribution area, such as that at Vukani. The kitchens may be staffed by community members, as was observed in three South African case study schools, and the facilities may be rented out to the public outside of school hours. Where such comprehensive facilities are unaffordable, the Musi Thusi school arrangement with its dedicated semi-outdoor spaces that students use during mealtimes, that are available for public use after school hours, provides a workable compromise.

Library/ICT Provision

Both Vukani and Atonsu Primary Schools had designated library spaces. The Vukani School library had been designed as part of the school and had an attached ICT area. Atonsu Primary school a library on the premises, that had been built by Dutch Diaspora Ghanaians from the neighbourhood. Both libraries were accessible to students but the Atonsu library building had no formal staffing and opened only one afternoon a week, depending on availability of staff volunteers. However neither library had adequate student book stocks. The Vukani Library did also provide a quiet study space for older students to use between classes and before school closed in the afternoons. As well as functioning successfully in this daytime role, the Vukani School Library and adjoining ICT area were also used by the local Adult Basic Education (ABET) Programme for evening classes.

Musi Thusi Primary school did not have a dedicated library but did have a portable library book box in most classrooms, comprising a small number of books for each class and age grade. There had been a room designed to be an ICT laboratory and a designated library area but there had been no provision of computers or book stocks for a full library. As Fourie (2007) states, although all South African schools are expected to have libraries, few have dedicated libraries on site, although the 'book box' project, comprising a small selection of books provided via the library service to appropriate level classrooms, is effective in schools like Musi Thusi Primary.

As of 2004, the South African government's ICT policy aimed to have computers in all primary and secondary school classrooms in the country by 2013 (SAIDE, 2005) with guaranteed internet access to urban and peri-urban schools and moves to have rural areas

connected via the national Telkom network to internet communications. Farrell, G. and Isaacs, S. (2007)

There is clearly diversity in coverage and quality of ICT and Library service provision across low and medium income countries. Dedicated built infrastructure for libraries and ICT facilities remains scarce in low and middle-income countries, and where it is available the resourcing in terms of equipment and staffing is often limited. In 2007 during the EdQual survey, access to wide scale mobile computing options for schools, such as the One Laptop Per Child, OLPC, (2011) project had yet to emerge in either Ghana or South Africa, despite there being trial projects in innovative mobile computing Traxler and Leach, (2006), Leach et al, (2005). Some researchers are predicting that in the future ICT provision in low-income countries is likely to depend on mobile laptops or mobile phones and less on PCs that require dedicated ICT/ computer laboratory areas (Leach, 2006; Apple, 2008). Furthermore, the use of e-books on digital tablets have the potential to revolutionise textbook and library services in schools and local communities. Kukulska-Hulme, A. and Traxler, J. (2006). What these predictions imply for school design is that space for quiet study, where students can work on individually owned mobile devices, is more likely to have utility into the future than storage space for books or dedicated computer laboratories.

Sanitation

Both Vukani and Musi Thusi Primary Schools had pipe-borne water on site. This helped ensure that the designed flush down toilet facilities functioned. However there was a level of vandalism and natural breakage of the porcelain-ware toilets and urinal and, in the case of Musi Thusi, also sink units. Water leakages and non- functioning single toilet units were also a problem in these and other schools visited with pipe-borne water supplies. Atonsu School, though in an urban neighbourhood, did not have pipe-borne water, but had a pit latrine system in place. This was in disrepair, and unsanitary for day-to day-use. Teachers interviewed confirmed that students often used surrounding areas as open air toilets and avoided the latrine blocks. No new latrine blocks had been built for the new pre-primary school block at the time data was collected.

The need for well-designed sanitation facilities for children is crucial for child welfare and health, both of which are major millennium development goals. In Ghana and South Africa, waterborne diseases such as dysentery, diarrhoea and cholera, are all rapidly spread in areas with poor sanitation. WHO, (2004), UNICEF, (2006), GSK, (2010). The design and planning of more relevant, robust sanitary facilities is a key challenge to meet to achieve improved children's health, and subsequently classroom welfare. The Ghana Architectural and Engineering Services Limited, (AESL) Service, a Government parastatal involved in designing other public infrastructure, such as police stations, was investigating the possibility of a moulded stainless steel sluice toilet system that would be more robust and easier to service and clean as a possible solution for school sanitation Uduku, (2007b).

The Druk White Lotus School discussed above demonstrates that the UN Ventilated Improved Pit latrine can work well within a school environment (Brislin, 2008). A cheap

innovative scheme using water bottles for handwashing has also been successfully used in Kenya, and is now internationally endorsed. WSP, (2008).

Good sanitation, robust toilet facilities and access to drinking water was a key issue for all three case study schools and the larger EdQual school design research project. Public utilities in urban areas in low-income countries are often unable to deliver uninterrupted water supplies. Furthermore in rural areas very few schools have access to boreholes, for drinking water, and the basic pit latrine toilets built on school premises are often dilapidated and not in use.

However the South African Council For Scientific and Industrial Research (CSIR), has worked with the United Nations and schools to improve access to sanitation, and has, like the Druk White Lotus school case study, successfully designed model schools in South Africa with 'VIP' latrines in rural areas. CSIR, (2005) There is also a government/UN backed publicity drive for the construction of VIP latrines in Ghana and other low-income countries. Thrift, (2007) The design of robust toilets for schools however is an issue for all schools, which needs to be addressed, the notion of the Ghana-police inspired, stainless steel units could be explored further

In the South African case studies visited, schools had standpipes for children's access to drinking water, where serviced water supplies were available. Also the Kenya handwashing model has been recently trialled in some rural schools with no access to pipeborne water. CSIR, (2006), SAIN, (2010) For schools in Ghana and other low-income countries however there is the need to plan access to boreholes or pipe-borne drinking water as a fundamental infrastructure requirement of all primary schools. This is because the evidence of its health benefits for children and the whole community, if access to borehole supplies can be negotiated, far outweighs the initial capital costs.

Local community outreach facilities

Within the three schools described here, the main areas designed for local community outreach were the library/ICT areas and open-air sports pitches. The sports pitches were the most accessible to local communities as few school grounds were fully fenced off from the surrounding community. This meant that outdoor sports pitches were in use during and after school hours, especially during weekends and holidays. However access to other formal facilities, including ICT areas and libraries, was highly policed and restricted by the official regulations, which school principals explained disallowed school use out of official school hours.

The exception was Vukani Primary school, where the school's ICT / library facilities were used for Government-funded Adult Basic Education evening classes. The school was also custom designed to allow for contemporary outreach with the positioning of the ICT/Library facilities near its main entrance and the ability to segregate the primary teaching areas from communal areas. The more entrepreneurial communities, such as Atonsu in Ghana, had been able to build a library facility for community as well as school use. The Atonsu library was regularly used for 'old students' meetings on

Sundays, out of school hours on a monthly basis. The more business-orientated head teachers were also able to informally hire out classrooms, as in the case of Musi Thusi, to religious and other groups for meetings and events out of school hours.

These activities are similar in vision to the Druk White Lotus and Ecuador schools where the school premises and its facilities are in effect “shared” by the local communities in which they exist. Whilst the Druk White Lotus and Kingsmead school models are much more expensive examples of new school design; with international funding and in a high income country respectively, the Ecuador model is an exemplar of local construction using local materials for the escuela nueva community school.

Conclusions: Some Key Design Messages

This section draws on the descriptions of successful aspects of the EdQual case study school design findings, highlighting their resonance with the international school case studies, whilst also identifying relevant design strategies that could be adopted.

The Case for Local Design Intervention

From the international examples and EdQual research case studies discussed, school design remains essential to improved educational experience in classrooms and at the same time enhance community life, with benefits for school-community relations. Returning to the first identified issue,

Classroom Size and Overcrowding

From the perspective of most successful learning environments were the Ecuador Escuela Neuva classroom and the Musi Thusi open area learning space. In both these cases, school planners had dispensed with the international design standards and instead explored how school design could integrate school and community functions within the its local context.

They were successful in developing large classroom spaces that best responded to the learning needs of the children in relation to their specific internal and external learning environment. Local construction materials, and building methods were used for each school’s construction, with the involvement of the community in the process. The key issue to be addressed at policy level is the move towards reduced prescription of space standards, and further advocacy of large flexible classroom design to encourage the provision of larger multipurpose spaces for different forms of learning, for pupils and at other times for communities, as shown in the Kingsmead and Vukani School designs.

Better Facilities Design

The VIP-toilet system in place at the Druk White Lotus School, has also been successfully used by the CSIR in exemplar schools in South Africa. (CSIR 2005) The cost and process for construction is not high, and as discussed earlier there are internationally backed policies in place in Ghana and other low income countries. However the VIP-toilet building programmes need better co-ordination, to ensure the policy publicity translates into implementation.

Local-Sustainability and Sufficiency

The use of solar photovoltaics and energy efficient heating systems has been described in the White Lotus and Kingsmead school examples. The Atonsu School library project also had photovoltaic panels (PVs) in place for evening lighting and basic power generation. The PVs however had fallen into disuse due, to lack of maintenance. Also at Musi Thusi Primary school and the Vilikanzi school, surveyed during the EdQual project, there had been an attempt at hydroponic water filtration systems, which would have enabled the school to have access to sustainable water supplies, again however both schemes were non-functioning due to a lack of technical support and maintenance of the schemes. However the school farm schemes operating in the Musi Thusi, Vukani and other South African Schools visited during the EdQual research project worked well.

Self-sufficiency for schools depends on the context and technical know how available to enable its maintenance and use. School farms have been successful in South Africa, PV systems less so, due to their maintenance needs.

Kingsmead and Druk White Lotus Schools show what technological self-sufficiency is possible with adequate support and equipment back-up. In rural African and other low-income countries, this technology is as yet unsustainable although in future, more robust, less ‘back up-dependent’ technology systems may change this. Farm projects, drawing on existing local expertise and support, are as shown successful examples of what benefits can be achieved from practicable local self-sufficiency programmes.

School Design For Future ICT Interventions

From the EdQual research conducted and current literature on school needs in poor areas in low income countries, the current most pressing need for communities is the provision of classrooms with adequate space for high level student enrolments, as discussed. The shift towards more learner-centred pedagogies and curricula (for more on this, see Halai in this book) suggests a need to consider the creation of flexible learning environments to respond to different learning needs and tasks. Coupled with this is the call for a rethink the design of traditional classrooms as experiential learning areas, that allow for the incorporation of more interactive group-learning methods and, at least in some settings, the use of mobile technologies across classrooms as opposed to being limited to a ICT laboratory. (See Uworwabayeho et al. in this book).

The larger classroom spaces being advocated would effectively deliver the space required for this transformation of learning to incorporate future ICT learning needs. Both the Escuela Nueva, learning community concept space and the large halls found in both the Ladak school and Vukani Primary school have the potential to ‘house’ these contemporary forms of collaborative learning practice, and be put to use for the immediate classroom space needs of schools.

Schools designed as Community Development “Hubs”

The concept of the school designed to be central to the community development hub, as the White Lotus and Vukani schools case studies demonstrate, in the design and inclusion other facilities such as health care centres and libraries as part of each ‘holistic’ school

school plan. This bringing together of the school and the community through the school as a vehicle for both schooling and community learning, strategically located to allow for shared local access, by the incorporation of public infrastructure, and accessible community resources has been a concept described by many, including Dudek, (2006) Smit and Hennessey, (1995) and Uduku (2000, 2010, 2011).

It also formed a key 'community-focused design' aspiration for previous UK Labour Government's education policy, particularly informing schools such as Kingsmead, designed as part of the 2004-2010 Building Schools for the Future Programme, BSF, (2008). Kingsmead School exemplifies this; located within an area of primary school demand, with hall and administrative facilities designed to be publicly accessible, and classrooms that are flexible, naturally lit and ventilated, and can be used for a range of learning tasks. Furthermore, its design for energy-efficiency and flexibility, taking into account future school needs. Despite Kingsmead's capital cost putting it out of the aspirations of low-income countries, its key design highlights can be identified in parts of the Musi Thusi school, which equally has flexible-designed learning spaces, good building interfaces with local community in its outdoor eating area and indoor-outdoor learning spaces, and demonstrates its self-sufficiency in food production and community links via school farm.

As the international case study schools discussed show, the use of learning spaces for different purposes, personal, group, and most recently technological, is crucial to new pedagogies, that encourage the construction of a personal and community learning experience in today's classrooms or learning environments.

However successfully designed schools that both support today's most pressing education needs, in combating overcrowding, through their designed classroom flexibility, evidenced here in the Atonsui, Musi Thusi and Kingsmead, case studies, and also respond to contemporary student-centred learning, are an international aspiration, for both high and low income economies. This has moved school design guidelines away from the conservative, mid 20th century UNESCO-classroom space standards, to local context specific guidelines, responding to the current educational and development needs of today's children and the communities to which they belong.

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Paper Highlights:

1. Primary schools designed for the poorest remain inadequate for the numbers enrolled, and for the basic needs and functions of today's classrooms. The key issue being overcrowding in classrooms.
2. This is largely due to the use of outdated international design standards for classroom design. This is further affected by poor provision of basic services such as: electricity, drinking water, sanitation, and limited or no ICT/library facilities.
3. Strategies for improved school design are suggested, using the evaluation of the recently completed EdQual research project school case studies, , and also recent international examples.
4. It concludes that schools designed with adequate access to infrastructure and basic ICT-library facilities, can become 'hubs' for development; providing local assets that can be shared by their communities.

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Photo Highlights Essay:

Druk
Ecuador
Inkwenkwezi

**Designing Schools for Quality:
An International, Case Study Based, Review**

Ola Uduku
School of Architecture, University of Edinburgh

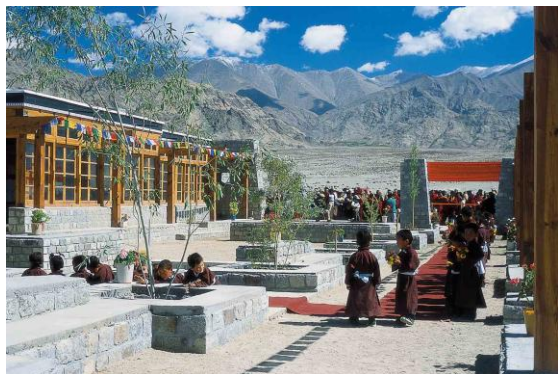
Photo Essay



Typical Classroom Kumasi, Ghana



Escuela Nueva Esperanza Ecuador -



Druk White Lotus School and Education Centre, Ladakh